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ECCENTRIC SHAFT COUPLING
[HENSHINJIKU TSUGITE]

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Specification /119*

1. Title:

ECCENTRIC SHAFT COUPLING

2. Claims

(1) An eccentric shaft coupling in which the end face of the drive shaft and the end face of the driven shaft are positioned to face each other; a plurality of grooves is provided on said end face of the drive shaft in a diagonal direction against the radial direction of the drive shaft; additionally, a plurality of grooves is provided on the end face of the driven shaft in a diagonal direction against the radial direction of the driven shaft so that these grooves correspond to grooves on the end face of the drive shaft; the direction of each groove on the end face of the driven shaft is such that it crosses the direction of the corresponding groove on the end face of the drive shaft; a drive force transmitting piece is placed between each groove on said end face of the drive shaft and the corresponding groove on said end face of the driven shaft; and a middle plate, placed between said end surface of the drive shaft and the end face of the driven shaft, has a through-hole which houses said drive force transmitting piece and maintains the relative position of all of the drive force transmitting pieces properly.

* Numbers in the margin indicates pagination in the foreign text.

(2) The eccentric shaft coupling according to Claim 1, wherein the drive force transmitting pieces are spherical pieces or circular cylindrical pieces.

(3) The eccentric shaft coupling according to Claim 1, wherein the drive force transmitting pieces also serve to maintain the gap between the end face of the drive shaft and the end face of the driven shaft in the direction of the drive shaft rotation or in the direction of the driven shaft rotation.

3. Detailed description of the invention

[Field of industrial application]

This invention relates to shaft coupling, and especially relates to an eccentric shaft coupling that can be produced for a low cost.

[Prior art and the problems to be resolved by this invention]

In various rotational force transmitting mechanisms, the ends of two shafts are connected by a coupling. In such a connection, even when both shafts have the same rotational center, axial eccentricity, namely a parallel displacement could occur between the two rotational centers of the drive shaft side and the driven shaft side for various reasons, and the eccentricity might persist all the time under some mechanisms.

Couplings that are used for these purposes include Oldham's coupling and Schmidt coupling. /120

However, this type of conventional eccentric coupling previously required high precision processing, too many parts, and very high costs.

Therefore, the objective of this invention is to provide an eccentric shaft coupling that can be produced for a low cost.

[Means for solving the problems]

The above objective can be achieved quickly with an eccentric shaft coupling in which the end face of the drive shaft and the end face of the driven shaft are positioned to face each other; a plurality of grooves is provided on said end face of the drive shaft in a diagonal direction against the radial direction of the drive shaft; additionally, a plurality of grooves is provided on the end face of the driven shaft in a diagonal direction against the radial direction of the driven shaft so that these grooves correspond to grooves on the end face of the drive shaft; the direction of each groove on the end face of the driven shaft is such that it crosses the direction of corresponding groove on the end face of the drive shaft; a drive force transmitting piece is placed between each groove on said end face of the drive shaft and corresponding groove on said end face of the driven shaft; and a middle plate, placed between said end surface of the drive shaft and the end face of the driven shaft, has a through-hole which houses said drive force transmitting piece and maintains the relative position of all of the drive force transmitting pieces properly.

With the eccentric shaft coupling of this invention, it is possible to use spherical or circular cylindrical pieces for drive force transmitting pieces.

With the eccentric shaft coupling of this invention, the drive force transmitting pieces can serve to maintain the gap between the end face of the drive shaft and the end face of the driven shaft in the direction of the drive shaft rotation or in the direction of the driven shaft rotation.

[Embodiment]

Concrete embodiments of this invention are explained next with illustrating drawings.

Figure 1 is a summary cross-sectional view of one embodiment of eccentric shaft coupling of this invention.

In Figure 1, the marking 2 indicates a drive shaft, and 2′ indicates its rotational center. Further, 4 is a driven shaft and 4′ is its rotational center. One end of the drive shaft 2 and an end of the driven shaft 4 face each other, and the two rotational centers 2′ and 4′ are placed to align each other.

The end of the drive shaft 2 is in a disk shape with a large diameter, whose end face 6 forms a flat surface which is at a right angle with the rotational center 2′ of the drive shaft. The end of the driven shaft 4 is also in a disk shape with a large diameter (with a smaller diameter, however, than the diameter of the end section of the drive shaft), whose end face 8 forms a flat surface

which is at a right angle to the rotational center 4' of the driven shaft. Further a middle plate 10 is placed between the end face 6 of the drive shaft and the end face 8 of the driven shaft.

Figure 2 is a skeleton view of the end face 6 of the drive shaft of the eccentric shaft coupling shown in Figure 1 above as seen from the driven shaft side in the direction of the rotational center of the drive shaft. This figure also shows skeleton view of the end face 8 of the driven shaft and the middle plate 10. Here, Figure 1 above corresponds to the cross-section at I-I in Figure 2.

As can be seen in Figure 1 and Figure 2, on the end face 6 of the drive shaft are formed grooves 7a, 7b, 7c, and 7d located at an appropriate distance from the rotational center 2' of the drive shaft and in a direction at a 45 degree angle to the radial direction. These grooves are arranged so that they divide the circumferential direction of the drive shaft in 4 equal parts. Similarly, on the end face 8 of the driven shaft are formed grooves 9a, 9b, 9c, and 9d located at an appropriate distance from the rotational center 4' of the driven shaft and in a direction at a 45 degree angle to the radial direction. These grooves are arranged so that they divide the circumferential direction of the driven shaft in 4 equal parts, and are located facing above-mentioned grooves 7a, 7b, 7c, and 7d on the end face 6 of the drive shaft. These opposing grooves on the drive shaft side and on the driven shaft side are orthogonal to each other.

Spherical pieces 12a, 12b, 12c, and 12d for transmitting the drive force are placed at each intersecting position of the grooves on the end face of the drive shaft and the corresponding grooves on the end face of the driven shaft. These spherical pieces are placed in the through-holes 11a, 11b, 11c, and 11d formed in the middle plate 10, and said middle plate serves to maintain the constant relative positions of all of the spherical pieces. When said middle plate does not maintain relative positions of the spherical pieces, each spherical piece can rotate freely in the groove on the end face 6 of the drive shaft and in the groove on the end face 8 of the driven shaft, producing a relative degree of freedom of the rotation of the drive shaft 2 and the driven shaft 4 within an appropriate angle relative to the circumferential direction. However, generation of such a degree of freedom can be suppressed with the above-mentioned middle plate 10. /121

As shown in Figure 1, a cover material 14 is provided on the outer perimeter section of the end section of the drive shaft, and this cover material has a shape that covers the end section of the driven shaft. Additionally, the end section of the driven shaft are convex spherical surface seats, on the surface that is opposite to the end face 8 where said grooves are formed, which are set apart at an appropriate interval in the circumferential direction. These spherical surface seats house and hold bearings 16 within them so that they can spin freely. These bearings are pressed by the above-

mentioned cover material 14 in the direction of the rotational center 2′ of the drive shaft. This structure allows the drive shaft 2 and the driven shaft 4 to pinch and hold the above-mentioned spherical pieces 12a ~ 12d in the sliding direction.

The working of this embodiment is explained next.

When, as shown in Figure 1 and Figure 2, the rotational center 2′ of the drive shaft and the rotational center 4′ of the driven shaft are aligned, the rotational force of the drive shaft 2 is transmitted to the driven shaft 4 via the spherical pieces 12a ~ 12d while maintaining the two center of rotations in alignment.

Figure 3 is a skeleton view similar to Figure 2, in which the driven shaft 4 is shifted in parallel upward only by a distance of D from the state shown in Figure 1 and Figure 2. In this case, the middle plate 10 is shifted by a distance of (D/2) upward and to right compared to above Figure 2 situation. In this Figure 3, the 10′ shows the symmetric center of arrangement of all of the through-holes 11a ~ 11d of the middle material 10.

Figure 4 shows a state in which the drive shaft 2 is rotated by 90 degrees in the direction of arrow A under the eccentricity D shown in Figure 3. In this case, the middle plate 10 is shifted by a distance of D to the left compared to above Figure 3 situation.

When the drive shaft 2 is rotated further in the direction of arrow A by another 90 degrees, we obtain the situation shown in Figure 3. And, subsequently, if the drive shaft 2 is rotated yet

again in the direction of arrow A, the situation shown in Figure 3 and the situation shown in Figure 4 will appear repeatedly. In this manner, the rotational force of the drive shaft 2 is transmitted to the driven shaft 4 via the spherical pieces 12a ~ 12d.

Even when the distance D between the rotational center 2' of the drive shaft and the rotational center 4' of the driven shaft changes continuously, the rotational force is transmitted smoothly and reliably as the spherical pieces rotate in the grooves on the drive shaft side and the grooves on the driven shaft side.

Figure 5 shows the relationship between the groove and the spherical piece at the cross-section that is at a right angle of the direction of the groove in the above embodiment. In the above embodiment, a spherical piece (12a) is used as the drive force transmitting piece, and the corresponding groove (7a) used is in an arc shape.

This invention does not limit the shapes of the groove and the drive force transmitting piece to those shown in above embodiment. For example, Figure 6, showing the equivalent section as above Figure 5, shows the case where a circular cylindrical piece (12a') is used as the drive force transmitting piece and the corresponding groove (7a') has a rectangular shape cross section.

Figure 7 is a summary cross-sectional view of one embodiment of the eccentric shaft coupling of this invention. This figure shows

parts corresponding to Figure 1 above, and the same codes are used to indicate the equivalent parts as Figure 1 above.

In this embodiment, the drive force transmitting pieces (12a", 12c") have a shape that has flanges at both end faces of a circular cylindrical piece. And the back of the grooves (7a", 7c") of the end face of the drive shaft and back of the grooves (9a", 9c") of the end face of the driven shaft have counter borings for coupling with the flange of above-mentioned drive force transmitting pieces.

Figure 8 is a skeleton cross-section view of the drive force transmitting piece of this embodiment. Two part materials 17 and 19 are inserted from the back of the grooves on the end face 6 of the drive shaft and the end face 8 of the driven shaft into the grooves. These two part materials 17 and 19 are bonded by thermal insertion or adhesive joining in order to form the drive force transmitting piece as well as to assemble the coupling.

Although not shown in Figure 7, under this embodiment, the direction and the number of the grooves on the end face 6 of the drive shaft and the end face 8 of the driven shaft are the same as under the embodiment shown in Figure 1 above.

Under this embodiment, the flange of the drive force transmitting piece serves as the bearing in the thrust direction as it is secured by the counter boring of the groove. Further, since this arrangement would enable maintaining the distance between the end face 6 of the drive shaft and the end face 8 of the driven shaft

at a prescribed distance, such materials as the cover material 14 and the bearing 16 shown under the embodiment in Figure 1 above are no longer necessary. /122

Although under the above embodiment, the end sections of the drive shaft 2 and the driven shaft 4 have a large diameter, forming the end face 6 of the drive shaft and the end face 8 of the driven shaft, it is also possible under this invention to mount an appropriate part material at the end section of the drive shaft or the driven shaft to form grooves on such a part material. The end face of the drive shaft and the end face of the driven shaft mentioned in this invention would also include these cases also.

[Advantageous effect of the invention]

The eccentric shaft coupling of this invention as mentioned above uses fewer parts and a simpler structure. It also enables easy production and a sufficient reduction in the costs.

4. Brief description of the figures

Figure 1 is a summary cross-sectional view of one embodiment of eccentric shaft coupling of this invention.

Figure 2, Figure 3, and Figure 4 are skeleton views of the end face of the drive shaft of the eccentric shaft coupling under this invention as seen from the driven shaft side in the direction of the rotational center of the drive shaft.

Figure 5 and Figure 6 show the relationship between the groove and the drive force transmitting piece of this invention at the

cross-section that is at a right angle of the direction of the groove.

Figure 7 is a skeleton cross-sectional view of the eccentric shaft coupling of this invention. Figure 8 is a skeleton cross-section of the drive force transmitting piece.

2 … Drive shaft; 2' … Rotational center of drive shaft;

4 … Driven shaft; 4' … Rotational center of driven shaft;

6 … End face of drive shaft; 8 … End face of driven shaft;

7a ~ 7d, 9a ~ 9d … Groove;

10 … Middle plate; 11a ~ 11d … Through-holes;

12a ~ 12d … Spherical piece;

14 … Cover-part material; 16 … Bearing.

Figure 1

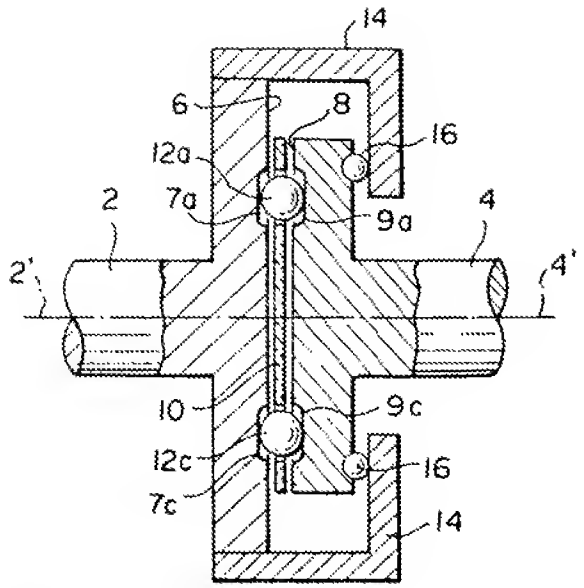

Figure 2

第 2 図

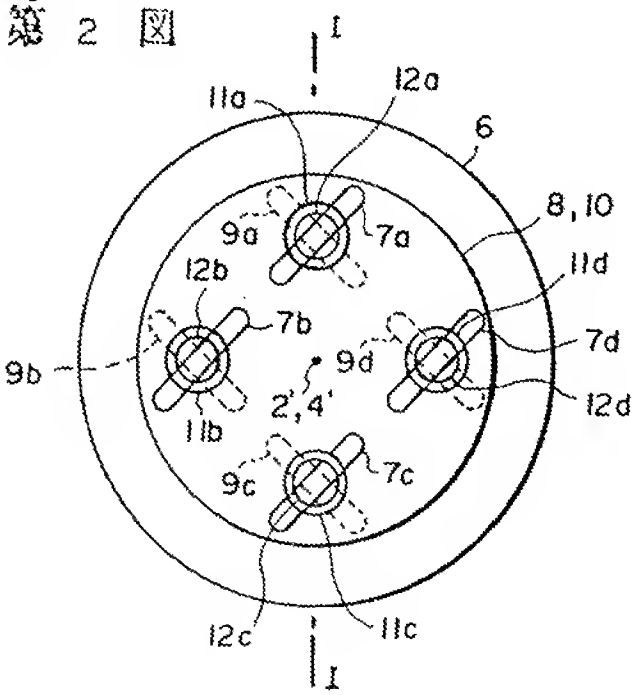

Figure 3

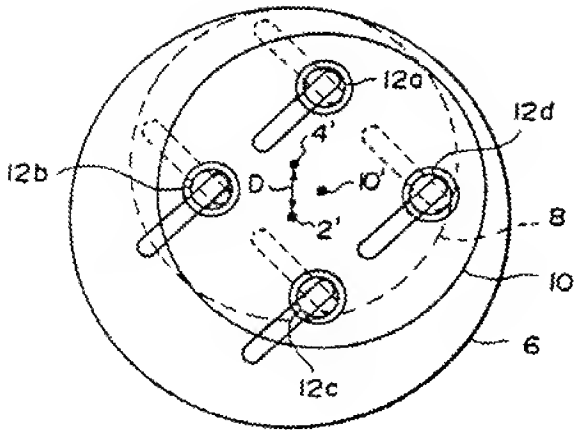

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Figure 4

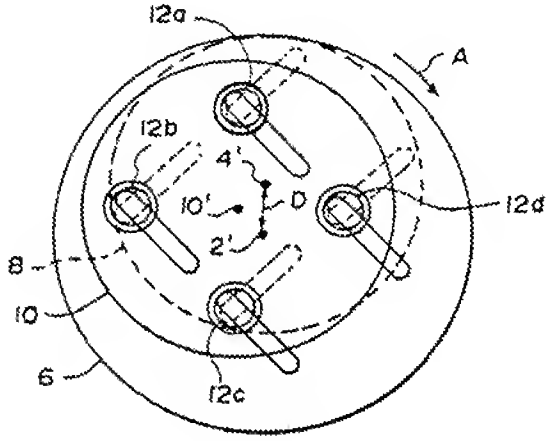

Figure 5

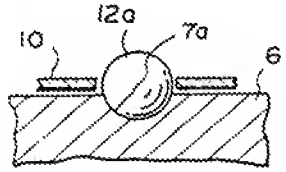

Figure 6

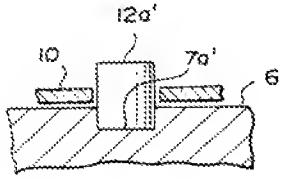

Figure 7

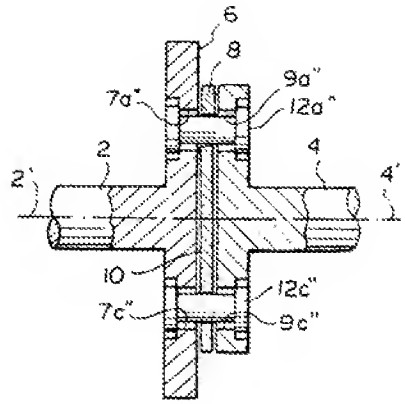

Figure 8